

ART. 1. LOCATION AND STRATIGRAPHY OF KNOWN
OCCURRENCES OF FOSSIL TETRAPODS IN THE UPPER
PENNSYLVANIAN AND PERMIAN OF PENNSYLVANIA,
WEST VIRGINIA, AND OHIO*

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INTRODUCTION

This paper presents geological and geographical descriptions of those localities in Ohio, Pennsylvania and West Virginia, at which tetrapod fossils were collected by field parties of Carnegie Museum during the years from 1934 to 1937. A brief summary of all localities discovered earlier is included in this description, and the positions of both the new localities and those previously known fossil occurrences are indicated on the map accompanying this paper.

Early in the spring of 1934 several short collecting trips were made into West Virginia, followed in succeeding years by field parties of Carnegie Museum under the direction of John J. Burke. These parties included Eugene Burke in 1935, Charles T. Agostini in 1936 and 1937, and the writer in all of those years. The success in finding these new localities in a region where so few tetrapods had been previously found was in a large part due to the able leadership and persistence of John J. Burke. The first account of these finds was made by him in *Science* (1935: 153) and later he wrote a popular article about the collection for the *Carnegie Magazine* (1937: 145-149).

In the field a much greater amount of time was devoted to searching for additional localities than was spent making thorough investigations of a few places. The reasons for the continued search for new localities were to determine just how widespread these vertebrate occurrences were and to attempt to find places where the fossils were better preserved and less fragmentary. When the localities were found it was planned to re-visit them and make further collections and field notes, but these plans were not carried out. Consequently, the field notes are in many instances quite incomplete, in some cases furnishing only the geographical locations and the kind of matrix in which the fossils occurred.

The collecting that can be done in southwestern Pennsylvania, northwestern West Virginia, and eastern Ohio, is rather restricted.

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Good outcrops are generally scarce and are found along road cuts and steep banks of streams. The exposures are usually of small extent, both laterally and vertically, and are frequently partly covered with residual soil, thus making difficult the identification of individual strata. Further, some of the beds of thin limestone in which fossils were found are apparently not lithologically constant.

The stratigraphic identifications of fossiliferous beds are based largely on information given in the publications of the U. S. Geological Survey and of state geological surveys of West Virginia, Pennsylvania and Ohio. Often the identifications are based upon the elevations which were taken from contours on topographic maps of the U. S. Geological Survey and are, of course, subject to some error. In a region such as the one here concerned, where thin fossiliferous limestones lacking distinguishing characteristics are closely spaced stratigraphically, an error in elevation can easily cause considerable confusion in the identification of those beds. Consequently, the identification of fossiliferous strata described in this paper are in many cases uncertain.

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GEOGRAPHY

The region with which this paper is concerned lies in southwestern Pennsylvania, northwestern West Virginia and eastern Ohio. In Pennsylvania the new fossil localities were found from Pittsburgh south and west to the West Virginia state line. The section of West Virginia which yielded vertebrates was much larger, extending from the northern part of Marshall County southwest into northern Putnam County, and east into western Monongalia County. The one new locality found in Ohio is in eastern Monroe County.

The area in which the collection was made is long and narrow, having a length in a general northeast-southwest direction of about 160 miles and a width in a northwest-southeast direction of about 40 miles. Locality no. 1 at Pittsburgh, Pennsylvania, is the most northern and the easternmost while locality no. 12 near Liberty in Putnam County, West Virginia, is the southern and westernmost. However, the older localities, which were found previous to the Carnegie Field Parties of 1934-1937 and which are briefly mentioned under "Previous Work" in this paper, do not all lie within this area.

The drainage of the region is tributary to the Ohio and Monongahela rivers. The Ohio and its lesser tributaries drain the northwestern part of the area while in the southwestern portion the drainage into the Ohio is largely by the Kanawha and the Little Kanawha rivers and their tributaries. The Monongahela river and its eastward flowing tributaries drain the eastern section of the area.

On the map of *Physical Divisions of the United States* by Nevin M. Fenneman and Douglas W. Johnson (1930), the area is included in the Kanawha Section of the Appalachian Plateaus Province of the Appalachian Highlands and is described as a "mature plateau of fine texture; moderate to strong relief."

GENERAL GEOLOGY

The outcropping rocks of this region are sedimentary deposits of shales, sandstones, limestones and coals of Pennsylvanian and Permian ages. The Pittsburgh series of the Pennsylvanian includes in ascending order the following groups: Allegheny, Conemaugh and Monongahela, all of which are found exposed in this area.

Overlying the Pittsburgh series is the Dunkard series, which includes two groups, the Washington and the Greene, these being the youngest

of the eastern Paleozoic deposits. The Dunkard series has generally been considered to be of Permian age and is so treated in this paper.

The general limits of the Dunkard series are shown in outline on the map of localities accompanying this paper. These limits were adapted from several maps made by the state geological surveys of Ohio, Pennsylvania and West Virginia. The narrow areas occupied by rocks of the Monongahela group in the valley of the Ohio River, in the valleys of many of the streams traversing the Dunkard area in eastern Ohio, and in the lower reaches of a number of the larger streams in western West Virginia are not indicated. In addition to the principal region occupied by the Dunkard series, as shown on the map, there are outliers of small areal extent in Ohio, West Virginia, Pennsylvania and Maryland. The most remote of these outliers from the main body of the Dunkard series deposits are near the town of Frostburg in Allegany County, Maryland.

The Greene group occupies the central part of the principal area of Dunkard series as delimited on the map. In traveling in any direction from the central portion of the area, one encounters progressively older strata from the Greene group to the Washington, the Monongahela and the Conemaugh. This progression from younger strata in the central part of the area to older strata toward the sides is indicative of the geosynclinal structure they occupy. This region includes the lowest portion of the Appalachian geosyncline, the axis of which trends in a general northeast-southwest direction from southwestern Pennsylvania across western West Virginia and into eastern Kentucky. The deepest portion of this elongate structural basin, according to Hennen (1909: 65-66), is probably in Wetzel County, West Virginia in the Nineveh syncline. Besides the Nineveh syncline there are a number of other synclines and anticlines within the Appalachian geosyncline which have been fully described and mapped by the geological surveys of the states in which they are found.

Another major structure of interest within the area is the Burning Springs anticline with its axis cutting almost north-south across Washington County, of Ohio and Pleasants, Wood, Ritchie, Wirt and Calhoun counties of West Virginia. This anticline, crossing the Appalachian geosyncline, elevates the strata to such an extent that a narrow belt of Allegheny, Conemaugh and Monongahela groups (six miles wide in the north to about one mile in the south) outcrops across parts of the counties named above.

General stratigraphic sections are included in the portion of this paper relating to new localities.

PREVIOUS WORK

Although no extensive prospecting for fossil vertebrates in this region was undertaken by any institution before the Carnegie Museum's field party, there had been a number of discoveries of tetrapod fossils made by various individuals. Those earlier localities, exclusive of places where footprints or only coprolites were found, are briefly mentioned below. The approximate geographic location of each previously discovered locality is indicated by a white letter within a small black square on the map accompanying this report. The same letters are used to designate the approximate stratigraphic positions of the fossiliferous strata of the respective localities on geologic sections given under the heading "New Localities." No geologic section is given for the Allegheny group since no new localities were found within its strata.

The earlier localities are listed immediately below in ascending stratigraphic order, the lowest being given first, etc. The works cited in localities A and B are not intended to represent complete bibliographies for the descriptions of fossils from those places.

PENNSYLVANIAN SYSTEM

PITTSBURGH SERIES

Allegheny Group

Locality A

The oldest locality in this region is at Cannelton, Beaver County, Pennsylvania. Besides fishes, a few amphibians were found here in the shale forming the roof of the Middle Kittanning coal, near the middle of the Allegheny group. Descriptions of some of the fossils found here were made by Moodie (1909) who also briefly reviewed the locality in a later paper (1916: 15-16).

Locality B

The well known Linton, Jefferson County, Ohio locality produced many fossil forms, most of the tetrapods being amphibians. Early notice of the amphibians found here was made by Jefferies Wyman (1856: 172-173), and he later described several of the specimens (1858: 158-163). Later, both Cope and Moodie, in numerous papers, described the forms from this locality. Recently, both M. Steen (1930: 849-981) and A. S. Romer (1930: 77-147) have restudied the Linton fauna. The

Linton cannel coal, at the Upper Freeport horizon at the top of the Allegheny group, was the fossiliferous bed.

Conemaugh Group

Locality C

The lowest tetrapod horizon in this group was found by P. E. Raymond (1907: 835) at Pitcairn, Allegheny County, Pennsylvania. E. C. Case (1908: 234-241) first described the fossils which are restudied by Dr. Romer in his accompanying paper. The fossils came from near the middle of the Conemaugh group, about 315 feet below the base of the Pittsburgh coal. The fossiliferous stratum is the Pittsburgh red shale, called the Round Knob horizon in Ohio (see Condit, 1912: 35-37).

Locality D

A locality near Jewett in Harrison County, Ohio, was mentioned by Condit (1912: 39, 283). Here, what was thought to be a limb bone of a reptile was found in the Ewing limestone. This bone was not further described and was later lost (see Case, 1915: 84). The Ewing limestone is not indicated on the general section of the Conemaugh group given on a following page of the present paper, but in some places in Pennsylvania as well as in West Virginia and Ohio it does occur near the middle of the Pittsburgh red shale (see I. C. White, 1891: 92 and Johnson, 1929: 65). The possibility that this Ewing limestone vertebrate horizon corresponds to that of the Pitcairn, Pennsylvania locality (Locality C of this report) was mentioned by Condit (1912: 283).

In addition to the Jewett, Ohio locality, Condit (1912: 28) stated that reptilian fossils were present in the Birmingham shale but he did not give the locations of any such occurrences. Case (1915: 84) mentioned that these fossils were lost before he had seen them. This occurrence of vertebrates is not indicated on the map or geologic sections of this paper.

Locality E

Near Saltlick Bridge P. O., Braxton County, West Virginia, was found what appeared to be the cast of a fossil bone at a point about 200 feet below the Pittsburgh coal and not far above the Ames limestone.

This cast was the subject of a paper by Case (1917: 817-821), but to quote from White (1917: 822) “. . . he (Case) did not think best to give it a name until other portions of the skeleton had been found.”

In White's paper just mentioned, he himself gave the specimen the name *Pareiasaurus* (?) *henni*. In regard to the application of a name to this specimen, Romer (1935: 1635) said, "This is unfortunate, for the specimen certainly does not pertain to *Pareiasaurus* (definitely confined to the upper Permian), and is doubtfully a fossil at all."

Locality F

The Montrose, Allegheny County, Pennsylvania locality, discovered by W. C. Darrah, was stratigraphically the highest to have been found in the Conemaugh group previous to 1934. The fossil amphibian at this place came from a carbonaceous shale at the Clarksburg horizon. The Clarksburg horizon is in the upper part of the Conemaugh group, about 100 feet below the Pittsburgh coal.

Monongahela Group

No tetrapods had been reported from this group previous to the one locality (locality no. 3) which the Carnegie field party found.

PERMIAN SYSTEM

DUNKARD SERIES

Washington Group

Locality G

At Oglebay Park, near Wheeling, in Ohio County, West Virginia, John L. Tilton (1930: 111) found a portion of a spine of *Edaphosaurus* sp. This fossil was found in the basal portion of the Elm Grove limestone, from 5 to 15 feet above the roof of the Waynesburg coal, and is stratigraphically the lowest to have been reported within the Washington group.

Locality H

Clinton R. Stauffer found a partial spine of *Edaphosaurus* sp. at Marietta, Washington County, Ohio (Stauffer, 1916: 88) (Stauffer and Schroyer, 1920: 147). The fossil-bearing bed was the Creston Reds, near the horizon of the Washington "A" coal. Since there are some differences in opinion as to the exact limits of the Creston Reds, the position of this locality on the geologic column of the Washington group for West Virginia on a following page of the present paper is only approximate.

Locality I

The locality at Portland, Jackson County, West Virginia, found by G. Carder and described jointly by R. W. Whipple and E. C. Case

(1930: 370-372), yielded fossils from the lower part of the Upper Marietta sandstone. The specimens from this place were identified by Case as parts of *Edaphosaurus cruciger* Cope.

Greene Group

Locality J

Three miles east of New Martinsville, in Wetzel County, West Virginia, J. L. Tilton (1926: 391-394) found tetrapods in the Nineveh limestone. The fossils found here were identified by Case (see Tilton, 1926: 392), as “. . . a collection of the intercentra of a rachitomous stegocephalian . . .”

Locality K

A few miles southeast of Rockport, Wood County, West Virginia, one caudal vertebra, not identified, is reported by Tilton (1926: 393). The horizon of the fossil-bearing bed is Lower Rockport limestone. The position of this locality on the map accompanying the present paper is uncertain.

Locality L

At Limestone Hill, Wirt County, West Virginia, vertebrates were found at the Upper Rockport limestone horizon. Whipple and Case (1930: 371) gave a preliminary list of the following tetrapod forms represented at this locality, including *Lysorophus*, *Theropleura*, *Dimetrodon* and *Trimerorachis*.

Locality M

The fossil found one-half mile east of McKinley Central Church, Wood County, West Virginia, is apparently stratigraphically the highest to have been found previous to 1935. Tilton (1926: 393) reported that the fossil, an intercentrum of the *Trimerorachis* type, came from the Gilmore limestone. The position of this locality on the map accompanying the present paper is uncertain.

Locality N

About five miles southwest of Cottageville, Jackson County, West Virginia, were found portions of the skeleton of a cotylosaur described by Dr. Romer in his accompanying paper. This specimen at the United States National Museum under Catalog No. 12166 was apparently found in a sandstone. The stratigraphic position of the fossiliferous stratum is not known, nor is the geographic position on the map

accompanying this paper certain. This occurrence is not indicated on any geologic column in this paper.

NEW LOCALITIES

This portion of this report consists of the stratigraphic and geographic descriptions of each locality at which collections were made by the Carnegie Museum field parties. Brief descriptive information concerning the geology of the area and several stratigraphic sections are included.

The Carnegie Museum localities are described on the following pages in ascending stratigraphic order, those in the Conemaugh group first, followed by the locality in the Monongahela group, etc. Each locality is designated by a number which has been assigned as nearly as possible in ascending stratigraphic order; that is, locality 1 being stratigraphically lower than locality 2, and 2 stratigraphically below locality 3, etc. These numbers are shown on most of the geologic sections in this paper to indicate the approximate stratigraphic positions of the fossiliferous beds of the localities they represent.

On the map accompanying this report the locality numbers appear in white on small black squares and indicate the general geographic positions of each fossil locality.

PENNSYLVANIAN SYSTEM

PITTSBURGH SERIES

Conemaugh Group

This group extends from the top of the Freeport coal up to the base of the Pittsburgh coal and is, according to Leighton (1939: 11), 600 to 630 feet thick at Pittsburgh, Pennsylvania. The coals are thin. Sandstones, shales and limestones make up the principal beds. Both fresh-water and marine limestones are present, and of the latter, Leighton (1939: 11) said, "These are more persistent than the shales, sandstones, or fresh-water limestones and are excellent key beds. A generalized section of the Conemaugh group is difficult to construct because of the great variations in most of its members."

Leighton's generalized section (1939: 11-12) is reproduced below, with additions by the writer parenthesized. The approximate stratigraphic positions of new localities in Pennsylvania and of previous localities in Ohio, Pennsylvania and West Virginia are indicated at the right of the section.

Section of the Conemaugh Group for Pennsylvania

	<i>Feet</i>	<i>Previous Localities</i>	<i>New Localities</i>
Shale and thin fresh-water limestones	35		
Shales	30		1, 2
Shales and thin fresh-water limestones	21		
Connellsville sandstone	15		
Shale	5		
Clarksburg coal	1/2	F	
Clarksburg limestone	3		
Clarksburg clay	8		
Vari-colored clays and shales	45		
Morgantown sandstone	33		
Wellersburg coal	1/2		
Wellersburg clay with nodular limestone	21		
Birmingham shale	30		
Duquesne coal	1		
Duquesne clay	9		
Grafton sandstone	2	E (?)	
Colored clays or shales	15		
Ames limestone, marine	3		
Harlem coal	1/2		
Pittsburgh red beds—clays	30	C, D	
Upper Saltsburg sandstone	30		
Bakerstown coal	1		
Bakerstown fresh-water limestone and clay	10		
Lower Saltsburg sandstone	20		
Woods Run limestone	1		
Woods Run coal	1/2		
Shales and clays	10		
Lower Woods Run limestone	1/2		
Shales	35		
Pine Creek or Cambridge limestone	2		
Buffalo sandstone	25		
Shales	30		
Brush Creek limestone, marine	1		
Shales	10		
Brush Creek coal	1		
Shales	10		
Upper Mahoning sandstone	27		
Mahoning coal, clay, limestone	15		
Lower Mahoning sandstone	25		

Locality 1: City of Pittsburgh, Allegheny County, Pennsylvania

Less than two miles from Carnegie Museum, a number of fossils were collected in an abandoned quarry. This quarry was located on the east side of Soho Street, two to three tenths of a mile north of Fifth Avenue. Several years after the collection was made, the quarry was completely covered under the fill for a large housing project. The elevation of the fossiliferous limestone is about 1,040 feet above sea level.

The fresh-water limestone which carries the fossils is two feet thick and has a thin shaly parting in the middle. The limestone is light

gray on fracture, but weathered surfaces are generally stained yellow and brown. Besides bone fragments many ostracods and worm tubes stand out on weathered pieces of the matrix.

By hand-level measurement this limestone was found to lie 40 feet beneath the base of the Pittsburgh coal and therefore can be considered to be a bed of the Pittsburgh limestone. The term "Pittsburgh limestone" is employed in this paper, as it has at times been used by the Pennsylvania Geological Survey (Johnson, 1929: 43); i. e., to identify those limestone beds which at times occupy positions between the base of the Pittsburgh coal and a point 70 feet beneath that coal. As thus defined, the Pittsburgh limestone includes within its limits the Lower Pittsburgh limestone of F. and W. G. Platt and others.

Locality 2: Collier Township, Allegheny County, Pennsylvania

In an abandoned quarry between Walkers Mills and Ewingsville, Pennsylvania, a few fragmentary fossils were collected in 1934. The quarry is about 250 feet northeast of the first railroad bridge over Robinson Run, along the tracks of the P. C. C. and St. L. railroad line going east from Walkers Mills. Approximate elevation of the quarry is 860 to 880 feet above sea level.

The fossils were found in a fresh-water limestone, 18 inches thick, which outcropped near the top of the quarry. This limestone is quite carbonaceous and is dark gray on a freshly fractured surface but weathers light brown to light gray. It lies immediately beneath a coal, one foot thick, and about 16 inches beneath a massive limestone, five feet thick. The coal one foot thick, immediately overlying the fossil-bearing bed, is apparently the Little Pittsburgh coal.

The limestone containing fossils was found by hand-level measurement to lie 25 feet beneath an outcrop of the Pittsburgh coal and may be considered to be a bed of the Pittsburgh limestone.

Monongahela Group

This group, with the Pittsburgh coal as its basal member and the Waynesburg coal as its uppermost member, yielded tetrapod fossils at but one place in this area, and no previous localities have been noted. The Monongahela group is conspicuous for the large number of fresh-water limestones included in its measures, so it is surprising that no other fossil tetrapod localities were found within its strata.

In Tyler County, West Virginia, the only place at which fossils were collected in this group, David B. Reger (1929: 139) gives a thickness of

300 feet for the Monongahela group. The general section given by him (1929: 140) is reproduced below omitting, however, the total feet and intervals included in his original section. The word "group" in the title below has been substituted for the word "series" which was used by Reger. At the right of the section the stratigraphic position of the locality is indicated by its number.

General Section of the Monongahela Group for West Virginia

	<i>Feet</i>	<i>Previous Localities</i>	<i>New Localities</i>
		None	
Coal, Waynesburg.....	5		
Shale, gray or red.....	10		
Sandstone, Gilboy, gray or green.....	35		
Coal, Little Waynesburg.....	1		
Limestone, Waynesburg, gray.....	4		
Shale, gray or red.....	13		
Sandstone, Uniontown, gray or green.....	35		
Shale, Annabelle, brown 15 ft. to.....	0		
Coal, Uniontown.....	2		
Shale, gray or red.....	10		
Limestone, Uniontown, gray or red.....	15		3
Shale, red or green, with thin sandstones and limestones	44		
Sandstone, Arnoldsburg, gray or green.....	30		
Coal, Lower Uniontown.....	1		
Limestone, Arnoldsburg, 7 ft. to.....	0		
Shale, Fulton Green.....	5		
Limestone, Benwood, gray.....	65		
Sandstone, Sewickley, gray.....	25		
Coal, Sewickley.....	5		
Sandstone, Lower Sewickley, gray.....	25		
Coal, Lower Sewickley, 2 ft. to.....	0		
Limestone, Sewickley, gray or yellow.....	43		
Sandstone, Cedarville, gray or green, 40 ft. to.....	0		
Coal, Redstone.....	4		
Sandstone, Weston, gray or green, 20 ft. to.....	0		
Limestone, Redstone, yellow.....	5		
Sandstone, Upper Pittsburgh, gray.....	15		
Shale, Weston, gray.....	5		
Coal, Pittsburgh.....	8		

Locality 3, Lincoln District, Tyler County, West Virginia

Fossils were found in an outcrop just north of Owl Run, one and one-half miles northeast of Sistersville, West Virginia, at the west side of the road (West Virginia Route 2) to Paden City. The approximate elevation of the outcrop is 650 feet above sea level.

The fossils were found in a bed of light gray limestone about one foot thick. The fossil-bearing bed is overlain by four feet of red shale over which is a one foot limestone, and beneath the fossil bed are two

to three feet of red shale under which is a nodular limestone two feet thick.

The "Sistersville Section" made by Hennen (1909: 120-121), taken about three-fourths of a mile above Sistersville, was used in determining the stratigraphic position of the fossil-bearing bed. The fossiliferous limestone is about 25 feet below what appears to be the coal identified as the Uniontown in Hennen's "Sistersville Section."

The fossil-bearing stratum at this locality is the second limestone below the Uniontown coal and is one of a series of thin beds of limestone, which at this place appear to represent the Uniontown limestone.

PERMIAN SYSTEM
DUNKARD SERIES
Washington Group

This group, the lower of the two groups in the Dunkard series, includes the strata from the top of the Waynesburg coal up to the top of the Upper Washington limestone. The thickness of the group is generally considered to vary from 250 feet to about 400 feet. The nature of the strata of the Washington group is shown in the sections given on the following pages.

The published geologic sections of both groups of the Dunkard series for Pennsylvania differ in many respects from those sections for West Virginia. A great many of the differences are no doubt due to variation of individual beds as they are found within the two states, but in addition there were, in the past, different names given in each state to the same individual stratum. In several cases the same name was used by geologists of both Pennsylvania and West Virginia in reference to different lithologic units. This condition could be rectified only by considerable field work and would require making many sections and visiting numerous type localities. No such ambitious task has been undertaken by the writer, but a statement was considered necessary to explain the employment and differences in the geologic sections for Pennsylvania and for West Virginia in both groups of the Dunkard series in this paper.

Some of the differences in the named stratigraphic units of the Washington group in West Virginia and in Pennsylvania may be seen in the two sections which are given on the following pages. Unfortunately, the Pennsylvania section does not include the less prominent and unnamed shales, limestones and sandstones and so does not

depict the true stratigraphic conditions as well as does the West Virginia section.

The positions of both the new and previous localities that were found in this group are indicated only on the geologic section of the state in which they were found. The only exceptions are that both new locality 6 and previous locality H, which are in Ohio, are shown on the West Virginia section, because no section for Ohio is included with this report.

The following section is taken from a general section of the Dunkard series for West Virginia which was given by Ray V. Hennen and David B. Reger (1913: 165-166). The lower part of their section is reproduced here, omitting only a series of figures of total feet which they gave in the original. The names in parenthesis, to quote Hennen and Reger (1913: 166) “. . . have all been added by the writer and others since the publication of the original Dunkard Creek section by I. C. White on page 22 of Bulletin 65 of the U. S. Geological Survey in 1891.”

*General Section of the Washington Group
Dunkard Series, for West Virginia*

	<i>Feet</i>	<i>Previous Localities</i>	<i>New Localities</i>
Limestone, Upper Washington.....	4		
Shale, limy.....	5		
Sandstone, (Hundred).....	34		
Coal, (Hundred) (5 in.) to.....	1		
Fire clay and red and variegated shale.....	34		
Sandstone, (Upper Marietta).....	50	I	9
Coal, Washington "A".....	1		
Shale, red, (Creston).....	60	H	
Limestone, Middle Washington.....	5		
Sandstone, (Lower Marietta).....	40		
Limestone, Lower Washington.....	2		
Coal, Washington.....	3		
Fire clay shale, (Washington).....	10		
Limestone, (Bristol).....	2		
Sandstone, Washington.....	10		
Coal, Little Washington.....	1		
Shale	7		7?
Sandstone, (Mannington) (Waynesburg "B" coal. horizon near middle).....	45		
Shale	4		
Coal, Waynesburg "A".....	1		
Fire clay and shale.....	3		
Limestone, Mt. Morris.....	2		6
Shale	12		
Sandstone, coarse, brown and pebbly, Waynesburg	45		5
Limestone, dark flaggy, (Elm Grove).....	3	G	4
Shale, dark, sandy with fossil plants, Cassville.....	5		
Coal, Waynesburg			

Variation within both the Washington and Greene groups in Pennsylvania made unsuitable any one general section hitherto published for those groups as seen in Pennsylvania, so the writer, using several publications, compiled composite sections of the principal geologic units for those two groups of the Dunkard series. Therefore, the section of the Washington group, given below, and of the Greene group for Pennsylvania, given on a following page, indicate the relative positions of the strata and show the irregularities in thickness as found in Pennsylvania but do not give a true section for any one place. The intervals between the named beds are not shown and vary in composition from place to place, but are generally shales and thin sandstones.

*General Section of the Washington Group,
Dunkard Series, for Pennsylvania*

	<i>Feet</i>	<i>Previous Localities</i>	<i>New Localities</i>
		None	
Upper Washington limestone.....	4-15		11
*Brier Hill sandstone.....	0-20		
Jollytown limestone (of R. W. Stone).....	1- 5		10
Jollytown coal (of J. J. Stevenson) 5 in. to 20 in.			
Jollytown sandstone (of d'Invilliers).....	?-40		
Middle Washington limestone.....	3-25		
*Upper Marietta sandstone.....	0-75?		
Washington "A" coal.....	0- 5		
*Middle Marietta sandstone.....	0-40?		
Blacksville limestone.....	3- 5		
*Lower Marietta sandstone.....	0-40?		
*Washington Rider coal.....	0- 1		
Lower Washington limestone.....	0-20		8
Washington coal.....	3-10		
Washington sandstone.....	5-25		
Little Washington coal.....	0- 1		
Taylortown limestone.....	0-20		
*Upper Mannington sandstone.....	0-20		
Waynesburg "B" coal.....	0- 2		
*Lower Mannington sandstone	0-30		
Colvin's Run limestone.....	0-10		
Waynesburg "A" coal.....	0- 4		
Mount Morris limestone.....	1- 5		
Waynesburg sandstone.....	10-70		
*Elm Grove limestone.....	0- 1		
Cassville shale.....	0-15		

Those beds which are starred have been included in this column after their use by Hickok and Moyer (1940: 145-152) in the Pennsylvania Geological Survey volume on Fayette County, Pennsylvania. These same starred beds were included here in this paper only after checking through various older reports on Washington and Greene

counties and finding that beds, stratigraphically and lithologically similar to them (as represented by Hickok and Moyer), had been previously noted to occur at places in Washington or Greene counties of Pennsylvania.

Comparison of the section of the Washington group for West Virginia with that for Pennsylvania, just given, shows numerous differences in the two sections. Some of the differences are due to mis-identification of strata and to the duplication of names applied to different stratigraphic units. One such instance, which concerns the stratigraphy of some of the fossil localities in this paper, is in those beds which are named the Jollytown coal, Jollytown limestone and the Jollytown sandstone. The history of those terms and their uses are briefly mentioned here.

The term "Jollytown coal" was first used by John J. Stevenson (1876: 48) as the name for a thin bed of coal which was found to occur from 20 to 75 feet *below* the Upper Washington limestone in Greene and Washington counties in Pennsylvania. That term has since been used in publications of the U. S. Geological Survey and Pennsylvania Geological Survey in that same sense, and is so shown on the general section of the Washington group, Dunkard series, for Pennsylvania in this paper. In publications of the West Virginia Geological Survey the name "Jollytown coal" is applied to a coal just *above* the Upper Washington limestone after the usage of I. C. White (1891: 34). Since the top of the Upper Washington limestone marks the upper limit of the Washington group of the Dunkard series, the Jollytown coal of White is in the Greene group. In the general section of the Greene group of the Dunkard series for West Virginia in this paper, White's interpretation is used.

The name "Jollytown limestone" was first used by I. C. White (1891: 34) in reference to a limestone, one to ten feet thick, occurring 25 to 30 feet below the Dunkard coal and above the Jollytown coal of White (1891: 34), which *overlies* the Upper Washington limestone. The term "Jollytown limestone" is used in this sense by the West Virginia Geological Survey and is so shown on the general section of the Greene group of the Dunkard series for West Virginia in this paper. In Pennsylvania, R. W. Stone (1905: 6) applied the name "Jollytown limestone" to a bed of limestone five feet or less thick, which occurred 30 feet above the "Jollytown coal" of Stevenson (1876: 48) and 20 feet *below* the Upper Washington limestone. This "Jollytown limestone"

of R. W. Stone is apparently Limestone V of Stevenson (1876: 48), which Stevenson later named the Franklin limestone (1907: 102). In reports of the U. S. Geological Survey and of the Pennsylvania Geological Survey since 1905, R. W. Stone's usage of "Jollytown limestone" has been followed. In the general section of the Washington group, Dunkard series, for Pennsylvania, the Jollytown limestone is shown in the position it should occupy according to Stone's definition.

The term "Jollytown sandstone" was first applied by E. V. d'Invilliers (1895: 2573) to "a massive sand deposit, or irregular structure, weathering into fantastic forms, appearing at many localities and helping the geologist to identify the Jollytown coal bed above it." The Jollytown coal bed he refers to is Stevenson's occurring *below* the Upper Washington limestone. The name "Jollytown sandstone" in this sense has not since been used as far as the writer could determine, but is indicated on the general section of the Washington group, Dunkard series, for Pennsylvania in this paper. Apparently, the Pennsylvania Geological Survey did not use the term "Jollytown sandstone" at all after it had been given by d'Invilliers. Recently, W. O. Hickok IV and F. T. Moyer (1940: 151) have given the name "Davistown sandstone" to a sandstone which is from 10 to 30 feet thick and medium to heavy bedded and which occurs beneath the Jollytown coal (of Stevenson) and above the Middle Washington limestone. This bed is found in Fayette County, Pennsylvania, to the east of Washington and Greene counties. Since the Davistown sandstone appears to occupy a stratigraphic position similar to that of the "Jollytown sandstone" of d'Invilliers, the possibility of their representing the same lithologic unit is suggested. In West Virginia, R. V. Hennen (1909: 196-197) gave the name "Jollytown sandstone" to a massive sandstone, five to 30 feet thick, found from five to 10 feet above the Jollytown coal (of White). The term "Jollytown sandstone," according to Hennen's definition, has been followed by the West Virginia Geological Survey. It is indicated in the general section of the Greene group, Dunkard series, for West Virginia in the present paper according to Hennen's definition.

Locality 4.—Sand Hill District, Marshall County, West Virginia

The fossils at this locality were found in an outcrop of limestone in the bed of a creek, known locally as Line Run. This creek is not named on maps but is the first stream to enter Wheeling Creek from the north, east of the town of Viola, West Virginia. The outcrop is about 60 feet northeast of an old church which is one and three-tenths

miles southeast of Viola. The approximate elevation of the fossiliferous limestone is 820 feet above sea level.

Fossils were found in one of several thin limestone beds which are gray and light brown in color and which make up a limestone horizon several feet in thickness. There is a sandstone horizon above these thin limestones.

From the Map of General and Economic Geology (Hennen, 1909) which indicates the outcrop of the Waynesburg coal, it appears that the fossil-bearing beds are not more than 20 feet above the Waynesburg coal. Apparently, the fossiliferous stratum is the Elm Grove limestone, which according to Hennen (1909: 247) is one to five feet thick and is five to ten feet above the Waynesburg coal in this area.

Locality 5.—McClellan District, Doddridge County, West Virginia

At a roadside sandstone quarry near the town of Centerpoint, West Virginia, a few fragmentary fossil bones were collected. The quarry is about 200 feet east of a bench mark (elevation 790 feet) which is located at the junction of the road which runs (east) up Pike Fork, with the road running in north-south direction through Centerpoint. The approximate elevation of the fossiliferous sandstone is 800 feet above sea level.

The sandstone is greenish gray in color and had a thickness of 20 feet or more. The fossils were found in blocks already broken from the quarry face, so it is not known from what part of the stratum they came.

In answer to the writer's request for advice in regard to this locality, Mr. John P. Nolting, Jr., Assistant Geologist of the West Virginia Geological and Economic Survey, very kindly suggested that the fossiliferous sandstone is more likely the Waynesburg sandstone than the Mannington. From the structure as indicated by Hennen (1912) on the Map of General and Economic Geology and with the intervals between the Washington and Waynesburg "A" coals also given by Hennen (1912: 172), it appears that the Waynesburg sandstone is the correct identification of the bed which at this place contained fossils.

Locality 6.—Adams Township, Monroe County, Ohio

The fossil-bearing outcrop of this locality is in the southwest quarter of Section 18, Township 3 North, Range 4 West. The strata containing fossils outcrop on the east bank of Herds Run (not named on maps), one and three-tenths miles southwest of the bridge over Sunfish Creek, at Cameron, Ohio. There is a U. S. Coast and Geodetic Survey pre-

liminary elevation marker number U66/1934 (preliminary elevation 877.6 feet) set in the face of a sandstone cliff, about 60 feet southwest, across the road (Cameron-Woodfield Road, Ohio State Route No. 78) from the outcrop. The approximate elevation of the fossiliferous outcrop is 862 feet above sea level.

Fossils were found in two layers of limestone each eight inches thick, in five inches of gray shale between the two limestones, and in the upper two feet of a gray shale bed which is eight feet thick and which immediately underlies the limestones mentioned above. The strata containing fossils vary in total thickness from two feet, four inches to three feet, nine inches.

The fossiliferous beds were found to lie from seven to ten feet beneath a coal, one foot thick. This coal, at an elevation of about 870 feet, has been identified as the Waynesburg "A" coal by Wilbur Stout, the State Geologist of Ohio, who has very kindly sent me a section which he had made at this place. In that section he identified the massive sandstone about 40 feet thick, unconformably overlying the Waynesburg "A" coal, as the Washington sandstone. With the aid of Wilbur Stout's section, the stratigraphic positions of the fossiliferous strata were found to be from seven to ten feet beneath the Waynesburg "A" coal. This stratigraphic position is at the horizon occupied by the Mount Morris limestone in West Virginia and Pennsylvania.

Locality 7.—Sand Hill District, Marshall County, West Virginia

The northernmost locality in West Virginia at which the Carnegie Field Party collected is about one and one-half miles southeast of Viola, West Virginia. The fossils were found in the limestone which forms the second waterfall as one goes (north) up Ruth Hollow from Wheeling Creek. Ruth Hollow is the valley of the second stream to enter Wheeling Creek from the north, east of the town of Viola, West Virginia. Neither Ruth Hollow nor the stream flowing in it are named on maps. The elevation of fossil outcrop is not known.

The fossiliferous fresh-water limestone is very dense and is gray on a fresh surface, but weathers to a yellowish gray. The thickness is not known.

Since no other information about this locality is available at present, the stratigraphic position of the fossil-bearing bed has not been determined. From Hennen's (1909) Map of General and Economic Geology of this area, it appears that the limestone in question lies between the Waynesburg and Washington coals, within the Washington group.

Locality 8.—Richhill Township, Greene County, Pennsylvania

A limestone outcropping along the ditch on the west side of Pennsylvania State Route No. 21 between Ryerson Station and Wind Ridge P. O., Pennsylvania, was found to contain vertebrate fossils. This point of outcrop is nine-tenths of a mile northeast of the bridge over the North Fork of Dunkard Fork at Ryerson Station, and has an approximate elevation of 1,060 feet above sea level.

The individual bed of limestone containing the fossils is dark gray, weathers to a light gray color, and has a thickness of two feet.

The fossiliferous limestone is in the lower part of the Lower Washington limestone. At this place, the Lower Washington limestone is ten feet thick, being made up of five or more beds of limestone each of which vary in thickness from three inches to two feet. The Washington coal, two to three feet thick, outcrops here just two feet beneath the base of the Lower Washington limestone.

Locality 9.—Clay District, Monongalia County, West Virginia

This locality is a road cut on the east side of the Blacksville-Hundred Road (West Virginia Route No. 7) about one and one-half miles west of Blacksville, West Virginia. The fossiliferous stratum is exposed about 100 yards northeast of the confluence of Miracle Run and Dunkard Creek. The approximate elevation of the fossil-bearing bed is 995 feet above sea level.

Fossils were found in a siliceous limestone lens about 15 feet in length which had a maximum thickness of six inches.

The stratigraphic position of the fossiliferous lens is not certain, but appears to be about 40 feet beneath the Hundred sandstone at the stratigraphic horizon of the Upper Marietta sandstone.

Locality 10.—Richhill Township, Greene County, Pennsylvania

At this locality fossils were found in an outcrop on the east side of the McCracken-Ryerson Station, Pennsylvania Road, two-tenths of a mile north of McCracken. The approximate elevation of the outcrop is 1,010 feet above sea level.

The stratum containing fossils is a brown, sandy shale. This shale lies two to six inches beneath a limestone five feet thick.

From the position of the Upper Washington limestone, as indicated on the Map of Areal Geology in the Rogersville Folio (Frederick G. Clapp, 1907) and from the intervals given there from that bed to the Jollytown limestone, it appears that the limestone immediately over-

lying the fossiliferous shale is the Jollytown limestone of R. W. Stone (see explanation of Jollytown limestone given on a previous page of this paper).

Locality 11.—West Finley Township, Washington County, Pennsylvania

At this locality fossils were found in an old limestone quarry about three and three-fourths miles southeast of West Alexander, Pennsylvania, on the road leading to West Finley. The quarry is on the east side of the road, eight-tenths of a mile southeast of Kimmins school-house. The approximate elevation of the quarry is 1,120 feet above sea level.

The fossils came from a layer which is 10 inches thick and is separated from the carbonaceous shale (containing plant fragments) above it by just three and one-half inches of shaly limestone. The base of the fossil-bearing bed is seven feet, nine inches below the top of the quarry (this measurement includes residual soil at the top). The fossil layer is a hard and compact, dark gray limestone on a fresh surface, but the weathered rock is best described as rotten, almost clayey, and brown in color.

The limestone in this quarry is the Upper Washington limestone at the top of the Washington group. It was identified by its thickness (here about nine and one-half feet) and the characteristic carbonaceous shale containing plant fragments, immediately overlying it. In addition a coal one foot, eight inches thick, which appears to be the Jollytown coal (of Stevenson), was observed in the east bank of the road, at a point three-tenths of a mile north of the quarry, giving an interval of 40 to 50 feet from the Jollytown coal up to the Upper Washington limestone.

Greene Group

All the Paleozoic strata in this region occurring above the top of the Upper Washington limestone are included in the Greene group of the Dunkard series. The thickness of the rocks so included is about 800 feet (J. J. Stevenson, 1876: 35) in extreme southwestern Pennsylvania and in parts of northwestern West Virginia. Erosion has reduced the thickness to varying degrees in the other regions covered by this group of strata, the maximum in Ohio being about 250 feet according to C. R. Stauffer and C. R. Schroyer (1920: 21).

The two sections given below illustrate differences in the named stratigraphic units in West Virginia and in Pennsylvania. The first is a section which was given by Hennen and Reger (1913: 165-166). Only

the upper part of their section is given here, the lower part having been given on a previous page of this paper. A series of figures of total feet given in the original section is omitted here. Additions or alterations made to their section by the present writer are enclosed in brackets, and to quote Hennen and Reger (1913: 166) in reference to this section, "The names in parenthesis—25 in number—have all been added by the writer and others since the publication of the original Dunkard Creek section by I. C. White on page 22 of Bulletin 65 of the U. S. G. Survey in 1891."

*General Section of the Greene Group
Dunkard Series, for West Virginia*

	<i>Feet</i>	<i>Previous Localities</i>	<i>New Localities</i>
Sandstone, flaggy (Upper Proctor).....	40		
Shale	15		
Sandstone, (Middle Proctor).....	25		
Shale	10		
Sandstone, massive, green, micaceous.....	25		
(Lower Proctor)			
Shale, red and variegated.....	35		
Limestone, Windy Gap.....	5		
Sandstone, massive, (St. Cloud).....	20		
Shale, sandy.....	4		
Coal, slaty, Windy Gap, 3" to.....	1		
Fire clay, shale, red, and variegated, with layers of limestones and sandstones.....	80		{33, 34, 35? 36? 37?
Sandstone, massive, Gilmore.....	30		
Coal (Gilmore).....	1		
Limestone (Gilmore)	1	M	32?
Shale, variegated and red, with thin sandstones...	93		
Limestone, Upper (Rockport).....	5	L	29? 30? 31
Sandstone, (Taylor)	30		
Limestone, Middle (Rockport).....	5		{25? 26? 27? 28?
Sandstone, and shale, buff and red.....	29		
Coal, (Nineveh "A") 3" to.....	1		
Limestone, (Lower Rockport).....	5	K	{18? 20? 21? 22 23
Shale, brown and variegated.....	15		
Sandstone, massive, coarse and brown, Nineveh....	25		
Shale, 1' to.....	4		
Coal, Nineveh	1		
Fire clay and limy shale.....	10		
Limestone, Nineveh	5	J	16, 17? 19?
Shale, variegated and red.....	30		
Sandstone, massive, (Burton).....	29		
Coal, Hostetter.....	1		
Shale, sandy, with thin sandstones.....	60		
Sandstone, massive, (Fish Creek).....	34		
Coal, (Fish Creek).....	1		13? 14?
Fire clay shale (Fish Creek).....	5		
Shale, sandy and red, with thin sandstones.....	29		

	<i>Feet</i>	<i>Previous Localities</i>	<i>New Localities</i>
Sandstone, massive (Rush Run).....	25		
Shale, sandy.....	5		
Coal, Dunkard.....	1		
Fire clay and shale, red, sandy and variegated....	29		
Sandstone, (Jollytown) [of R. V. Hennen].....	20		12?
[Limestone, Jollytown of I. C. White.....	1]		
Coal, Jollytown [of I. C. White].....	1		
Fire clay.....	1		

The section given below is a compilation of the principal geologic units taken from several publications and does not give an accurate section for any one place. Intervals, generally of thin sandstones and shales, occurring between named units are not shown.

*General Section of the Greene Group
Dunkard Series, for Pennsylvania*

	<i>Feet</i>	<i>Previous Localities (None)</i>	<i>New Localities</i>
Proctor sandstone and concealed.....	40-115		
Windy Gap limestone.....	4- 5		
Windy Gap coal.....inches to.....	1		
Gilmore sandstone.....	25- 40		
Gilmore coal.....less than.....	1		24?
Nineveh sandstone.....	15- 30		
Nineveh coal.....inches to.....	1		
Nineveh limestone.....	4- 10		15
Hostetter coal.....1" to15".....			
Claysville limestone (position not certain).....	6- 8		
Fish Creek sandstone.....	10- 60		
Dunkard coal (Fish Creek coal).....	1- 2		
Prosperity limestone.....	10- 20		
Ten Mile (Sparta) coal.....	0- 3		
Donley limestone.....	5- 8		
*Dunlap sandstone.....	?- 31		
Upper Washington coal.....	0- 1		

* The Dunlap sandstone was recently described by Hickok and Moyer (1940: 152-153) from its occurrence in Fayette County, Pennsylvania. As mentioned by them, J. J. Stevenson had noted (1876: 35-36), but did not name, a sandstone at the same stratigraphic horizon in Washington County, Pennsylvania.

It should be mentioned that there is an interval totaling about 200 feet composed of shales, sandstones and an occasional limestone between the Nineveh sandstone and the Gilmore coal in the section just given. It is quite probable that with further work on the stratigraphy of the beds included in that interval, correlations with beds which appear to be at the same stratigraphic horizons in West Virginia could be made.

Locality 12.—Union District, Putnam County, West Virginia

Fossils were found along the north side of the road from Liberty to Paradise, about four-tenths of a mile southwest of Liberty, West Virginia. The approximate elevation appears to be near 1,000 feet above sea level.

The fossil-bearing sandstone is greenish-gray in color and is 25(?) feet or more in thickness. It was being quarried for road material at the place where the fossils were collected.

Since no sections were made here, nor was the locality revisited, the stratigraphic position of this sandstone is not known. From the Maps of General and Economic Geology (C. E. Krebs, 1911; and C. E. Krebs and D. D. Teets, 1914) it appears that the fossil-bearing sandstone may be the Jollytown (of Hennen) in the lower part of the Greene group. This identification is not certain and it is possible that the bed in question may be the Hundred sandstone, 30 feet or more below the Jollytown sandstone and included in the upper part of the Washington group.

Locality 13.—Proctor District, Wetzel County, West Virginia

An outcrop containing fossils was found on the east side of the road which runs southwest from St. Joseph to the confluence of Brushy Fork and Whetstone Creek, just one and two-tenths miles from the Catholic Church at Saint Joseph. This outcrop is just above a hair-pin turn in the road and about one-tenth of a mile east of the bridge over Whetstone Creek. The approximate elevation of the outcrop is 1,020 feet above sea level.

Fossils were found in a fresh-water limestone, gray in color and two to four inches thick, and in a few inches of gray shale immediately beneath this limestone.

The stratigraphic positions of the fossil-bearing limestone and shale have not been definitely determined, but apparently they are near the stratigraphic horizon of the Fish Creek coal.

Locality 14.—Liberty District, Marshall County, West Virginia

A few fragmentary fossils were taken from a bed which outcrops on the east side of the Cameron-Bellton Road (U. S. Route No. 250), just four-tenths of a mile (car mileage) northwest of the bridge over the Pennsylvania Fork of Fishing Creek. This bridge is about four-tenths of a mile west of Bellton. The elevation of the fossil-bearing bed may be from 1,000 to 1,050 feet above sea level.

Fossils were found in a light gray limy shale. The thickness of the bed is not known.

The stratigraphic position of the bed is not known, but from the Bellton Sections given by Hennen (1909: 141-142) it is evident that it is well above the Upper Washington limestone and apparently near the horizon of the Fish Creek coal.

Locality 15.—East Finley Township, Washington County, Pennsylvania

The quarry in which fossils were found is on the road which runs south from Claysville, Pennsylvania, along the ridge dividing the drainage of Buffalo Creek (to the east) and Robinson Run (to the west). The quarry is on the east side of this road (Pennsylvania Route No. 231), two and two-tenths miles south-southeast of the town limits of Claysville as indicated on the U. S. Geological Survey Map of the Claysville Quadrangle. The approximate elevation at the quarry is 1,460 feet above sea level.

The fossils were found in one of the several thin limestones which outcrop in the quarry. It is not known from which of the thin beds of limestone the fossils came. The total thickness of the limestones outcropping here is estimated to be eight to ten feet.

This fossiliferous limestone appears to be the Nineveh limestone. From the Structure and Economic Geology Map in the Claysville Folio (M. J. Munn, 1912) it appears that the quarry is about 320 feet above the horizon of the Upper Washington limestone, which bed was used as the key bed for the structure contours. The interval between the Upper Washington limestone and Nineveh limestone, as determined from figures given by Munn (1912: 7), is 315 feet.

Locality 16.—Tucker District, Wirt County, West Virginia

The fossil-bearing stratum outcrops a short distance, probably less than half a mile, south of Limestone Hill, West Virginia. The outcrop is on the east side of the road from Limestone Hill to Lockhart P. O. (U. S. Route No. 21). The elevation of the outcrop is uncertain but appears to be about 1,000 feet above sea level.

The fossils were found in the fourth prominent limestone to be seen outcropping along the east side of the road as one proceeds south down the hill from Limestone Hill. This limestone and a few inches of gray shale immediately above it were found to be fossiliferous.

This limestone is apparently the Niniveh limestone and the three

limestones above it appear to be the Lower, Middle, and Upper Rockport limestones. R. W. Whipple and E. C. Case (1930), who collected fossils from the Upper Rockport limestone at this locality, also mention the occurrence here of the Nineveh, Lower Rockport and Middle Rockport limestones.

Locality 17. — Liberty District, Marshall County, West Virginia

Three localities were found at different levels along the road which leads south toward Howard, West Virginia, from a schoolhouse which is about four-tenths of a mile northeast of Adaline, West Virginia. In addition to locality 17, there are localities 26 and 32 which are described later in this paper.

Locality 17 is three-tenths of a mile east of Adaline and about two-tenths of a mile south-southwest of the schoolhouse mentioned in the paragraph above. The outcrop from which the fossil was taken is at the south side of the road. The approximate elevation at this point is 1,000 feet above sea level.

A fresh-water limestone two feet thick was found to contain fossils. This limestone is compact in the lower one foot but is shaly in the upper portion. It was from this upper shaly part of the bed that the specimen was taken. This fossiliferous limestone is no. 26 in the Adaline Section given below.

The Adaline Section is included here because it was used in attempting the identification of fossiliferous strata at localities 17, 26, 27 and 32.

Adaline Section

This is a hand-leveled section made in 1936 by John J. Burke and the writer. The base is at water level on Fish Creek, 50 feet up-stream (south) of the bridge crossing that creek, seven-tenths of a mile northeast of Adaline, West Virginia. The section was made from that point in a general southerly direction along the road toward Howard, West Virginia. The top of the section is near the top of the ridge at the lane leading to the first farm house on the west side of the road. The lane at which the section ended is one and one-tenth miles south of the starting point at the base of the section.

Top of Section

		<i>Thickness</i>		<i>Total</i>	
		<i>Ft.</i>	<i>In.</i>	<i>Ft.</i>	<i>In.</i>
80.	Concealed	5		568	1
79.	Sandstone, massive, brown	16		563	1
78.	Concealed	4		547	1
77.	Limestone	1		543	1
76.	Shale, red and gray	5		542	1
75.	Shale, red in upper part, concealed below	6		537	1
74.	Concealed	11		531	1
73.	Sandstone, massive	5		520	1
72.	Concealed	11		515	1
71.	Shale and sandstone	21		504	1
70.	Limestone, fossiliferous		5	483	1
<i>(Locality 32)</i>					
69.	Shale, red	8		482	8
68.	Sandstone, massive	8		474	8
67.	Shale, red and green	2		466	8
66.	Sandy shale, variegated	14		464	8
65.	Shale, red	5		450	8
64.	Shale, sandy, gray	6		445	8
63.	Shale, red	7		439	8
62.	Sandstone	8		432	8
61.	Shale, brown and red	19		424	8
60.	Concealed	5		405	8
59.	Shale, dark		6	400	8
58.	Sandstone	7		400	2
57.	Shale	1	6	393	2
56.	Sandstone	4		391	8
55.	Shale, red; large limy nodules in lower part	4		387	8
54.	Sandstone, calcareous		7	383	8
53.	Shale, bluish, nodular near top	7		383	1
52.	Concealed	11		376	1
51.	Limestone	1		365	1
50.	Shale	2	6	364	1
49.	Limestone		7	361	7
48.	Concealed with red shale showing near base	5		361	
47.	Shale, gray, carries plant fossils	13		356	
46.	Shale, clayey, with coaly streaks		7	343	
45.	Coaly shale		2	342	5
44.	Shale, limy; with limy nodules, large in upper part, occasional bone fragments	5	9	342	3
43.	Limestone, weathers brownish, fossiliferous		7	336	6
<i>(Locality 26)</i>					
42.	Shale, red; grades upward into limy shale	6	10	335	11
41.	Sandstone	6		329	1
40.	Concealed with red shale showing near base	4		323	1
39.	Shale, red and green, sandy at base	10	6	319	1
38.	Shale, sandy	16		308	7
37.	Shale, green, poorly laminated	1		292	7
36.	Sandstone	5		291	7
35.	Shale, brown and red	7		286	7
34.	Limestone, sandy and irregular		4	279	7
33.	Shale, sandy, reddish	1		279	3
32.	Sandstone	1		278	3
31.	Shales, red and green	6		277	3
30.	Shale, sandy	2	6	271	3

(Continued on page 28)

		Thickness		Total	
		Ft.	In.	Ft.	In.
29.	Shale, red and brown	5	6	268	9
28.	Sandstone	2	6	263	3
27.	Shale, red and brown	4		260	9
*26.	Limestone, shaly in upper portion, fossiliferous in shaly part (<i>Locality 17</i>)	2		256	9
25.	Shale, sandy, calcareous at top	9		254	9
24.	Limestone, sandy irregular		4	245	9
23.	Shale, blue-gray, with limy nodules	5	6	245	5
22.	Sandstone, gray, thin-bedded near base	12		239	11
21.	Sandy shale in lower four feet; concealed above	21		227	11
20.	Sandstone, massive below, thin-bedded above	13	6	206	11
19.	Shale, brown and clayey	8		193	5
18.	Clay		3	185	5
17.	Shale, sandy, grading upward into clayey shale	5	6	185	2
16.	Sandstone in lower six feet; shale above	12		179	8
15.	Shale, clayey, brownish-green	8		167	8
14.	Sandstone, thin-bedded and gray	16		159	8
13.	Concealed	39		143	8
12.	Limestone		6	104	8
11.	Concealed, some red shale at top	39		104	2
10.	Shale, brown and gray	5	6	65	2
9.	Shale, blue with flat concretions	4	6	59	8
8.	Shale, carbonaceous	1	6	55	2
7.	Limestone		2	53	8
6.	Shale, sandy	4		53	6
5.	Sandstone	1		49	6
4.	Shale, blue	5		48	6
3.	Limestone (carries bone fragments; none collected)		6	43	6
2.	Shale, blue, with limy nodules	11		43	
1.	Concealed to level of Fish Creek, 50 feet south of the bridge	32		32	

* The identification of this bed (no. 26) containing fossils at locality 17 is not certain. From the position of the Nineveh limestone at about 1,090 feet in the Lynn Camp Section (Hennen, 1909: 87-89) and from the structure as shown on the Map of General and Economic Geology (Hennen, 1909) it appears that the Nineveh limestone should occur at about 1,000 feet at Adaline, as does this particular stratum. (The Lynn Camp Section was made about three miles west of Adaline.) From those figures alone it appears that the stratum in which the fossil was found may be the Nineveh limestone.

At the other localities found nearby, (localities 26, 27 and 32) stratigraphic determinations are dependent upon this rather uncertain identification of bed no. 26 of the Adaline Section at locality 17 as the Nineveh limestone.

Locality 18. — Clay District, Marshall County, West Virginia

The fossil-bearing stratum outcrops on the north side of the northern ridge, dividing the valleys of Hog Run and Fish Run. The outcrop is about eight-tenths of a mile due east of the southern end of Captina Island which is in the Ohio River, between Captina, West Virginia, and Thompson P. O., West Virginia. This locality is about two miles southwest of locality 20. The approximate elevation of the outcrop is 1,240 feet above sea level.

Fossils were found in a thin fresh-water limestone which resembled the limestone of locality 20.

The exact stratigraphic position of the fossiliferous stratum is not known. From its apparent elevation it seems probable that the bed in question is at the horizon of either the Lower Rockport limestone or the Nineveh limestone. More field work would be necessary to definitely identify this fossil-bearing limestone.

Locality 19. — Liberty District, Marshall County, West Virginia

A fossil was found on the bank at the east side of the Bellton-Littleton Road (U. S. Route 250), three-tenths of a mile southwest of Bellton, West Virginia. The approximate elevation at this point is 1,160 feet above sea level.

The fossil was not found in place and the stratum from which it came was not definitely determined. The matrix adhering to the fossil was a light gray shale. It is probable, but not certain, that the fossil came from one of the shales between the several thin limestones which outcrop along the road at this place. This limestone horizon is composed of four or five thin layers of limestone which have a total thickness of about eight feet.

The stratigraphic position of this limestone horizon is not certain, but it may be at or near the Nineveh limestone. It appears that these thin limestones (at an elevation of about 1,160 feet) are approximately 260 feet above the Jollytown coal (of I. C. White), which according to Hennen (1909: 202) outcrops at about 900 feet above sea level, one-fifth of a mile below Bellton. The interval between the Jollytown coal and the Nineveh limestone was 270 feet in Hennen's Littleton Section (1909: 148-149), made about five miles southeast of locality 19.

Locality 20.—Clay District, Marshall County, West Virginia

One mile south of the mouth of Grave Creek, a fossiliferous limestone was found outcropping on both sides of the road (West Virginia

Route No. 88) leading south from Moundsville, West Virginia, along the ridge toward Riggs Knob. This point of outcrop is two to three-tenths of a mile north of Briggs schoolhouse. The approximate elevation of the fossiliferous stratum is 1,260 feet above sea level.

The fossils were found in a bed of fresh-water limestone three to four inches thick. It is underlain by five feet of red shale below which is a non-fossiliferous limestone two inches thick.

A hand-level measurement was made by John J. Burke and the writer from an outcrop of the Washington coal, at the side of the road about seven-tenths of a mile north of the fossil-bearing outcrop, up (south) to the fossiliferous stratum. This measurement showed that the fossiliferous limestone lies 334 feet above the Washington coal. When compared to Hennen's Hog Run Section (Hennen, 1909: 145-146), which was made about three miles southeast of the fossiliferous outcrop, it appears that the limestone 334 feet above the Washington coal may lie about 25 feet above the Nineveh limestone, if the stratigraphic intervals remain constant between Hog Run and locality 20. This thin, fossiliferous limestone at locality 20, therefore, may represent the horizon of the Lower Rockport limestone.

Locality 21.—Liberty District, Marshall County, West Virginia

This fossil locality is one and eight-tenths miles south of Cameron, West Virginia, on the road leading up (southeast) to the top of Big Run Ridge from the eastern branch of Big Run. The fossiliferous stratum outcrops along the north side of this road, just two-tenths of a mile (car mileage) northwest from its junction with the Cameron-Bellton Road (U. S. Route No. 250). The approximate elevation of the fossil-bearing bed is 1,280 feet above sea level.

Fossils were found in a light brown, fresh-water limestone four inches thick. A coal eight inches thick outcrops about 40 feet above the fossil bed. Another limestone about eight inches thick, in which no fossils were seen, outcrops between the fossiliferous stratum and the coal.

The stratigraphic position of the fossiliferous limestone is not known. However, from the fact that the Nineveh coal is said by Hennen (1909: 176) to outcrop at about 1,235 feet in this vicinity, it appears that the bed in which the fossils were found may represent the horizon of the Lower Rockport limestone, about 40 feet above the Nineveh coal.

Locality 22.—Proctor District, Wetzel County, West Virginia

A fossil-bearing stratum outcrops along the east side of the road from West P. O. to Silver Hill, West Virginia, about three-tenths of a mile east of West P. O. The approximate elevation of the outcrop is 1,140 feet above sea level.

A few fossils were collected here from a fresh-water limestone which is six inches to one foot in thickness. It weathers to a yellowish-brown but is a dark gray on a freshly broken surface.

It appears that this fossiliferous limestone is the same one shown in Hennen's West P. O. Section (Hennen, 1909: 154-156) to lie 60 feet above the base of the Nineveh limestone. This bed is apparently the Lower Rockport limestone.

Since the stratigraphic determinations of fossiliferous beds at the locality just given and at localities 23, 33, 34, 35, 36 and 37 (all of which are within three miles of West P. O., West Virginia) are in part based upon Hennen's West P. O. Section, the writer has reproduced it and part of a paragraph following it from the Marshall, Wetzel and Tyler County Report of the West Virginia Geological Survey by Ray V. Hennen (1909: 154-156).

"A section measured by aneroid northwest down hill road from the top of a high knob located one mile southeast of West P. O., on head of Middle Fork of Lynn Camp run, Proctor District, gave the following succession for the Dunkard series:

Section at West P. O. (Proctor District)

	<i>Feet Thickness</i>	<i>Feet Total</i>		
Sandy shale from top of knob	15.0	15.0		
Sandstone and concealed				
to bench	50.0	65.0		
Concealed mostly sandstone			Proctor	
to bench	30.0	95.0	sandstones	151'
Concealed, mostly sandstone				
with steep bluff	55.0	150.0		
Limestone, gray and hard, Windy Gap	1.0	151.0		
Coal, slaty (8"), Windy Gap	1.0	152.0		
Limy shale, concealed and flaggy sandstone	10.0	162.0		51'
Concealed and shale	40.0	202.0		
Limestone, gray and hard	1.0	203.0		
Shale, sandy	2.0	205.0		17'
Concealed	14.0	219.0		
Limestone, dark gray	1.0	220.0		
Concealed and sandstone	10.0	230.0		61'
Red shale	20.0	250.0		
Concealed, mostly sandstone, Gilmore	30.0	280.0		326'
Shale, variegated with 2 thin sandstones..	50.0	330.0		
Concealed	55.0	385.0		
Flaggy sandstone and concealed	10.0	395.0		149'
Sandstone, massive, coarse, Taylor	20.0	415.0		
Concealed, sandstone and shale	14.0	429.0		
Limestone, gray and hard	1.0	430.0		
Concealed	5.0	435.0		
Sandstone and concealed	20.0	455.0		48'
Sandstone, flaggy at bottom, Nineveh	20.0	475.0		
Shale	2.0	477.0		
Coal, Nineveh (1090' L—A.T.)	0.5	477.5		
Black slate and flaggy sandstone	4.0	481.5		
Limestone, gray and hard, silicious, Nin- evah to creek	8.5	490.0		653'
Interval, supplied from average intervals between Wileyville and Denver	640.0	1130.0		
Waynesburg coal				

This is a very important section in that an almost vertical measurement is obtained for interval (326 feet) from the Nineveh up to the Windy Gap coal. This is the only exposure of the latter seam found by the writer in either Wetzel or Tyler. It is important for the reason that it shows that this latter seam comes 128 feet above the base of the Gilmore sandstone. In this interval are found 2 limestones, each 1 foot thick and 16 feet apart, the lower of which comes 60 feet above the base of the Gilmore sandstone. Another limestone appears in the

section, 47 feet above the Nineveh coal. There also appears to be 150 feet of measures on above the Windy Gap limestone, that are mostly made up of great sandstone masses. The Nineveh limestone is present in good thickness, as well as the Nineveh, Taylor and Gilmore sandstones. The interval from the Nineveh coal up to the base of the Gilmore sandstone is 197 feet."

Since the Rockport limestones had not been named or described when this section was made, it is possible that the limestone 60 feet above the Nineveh limestone may represent the Lower Rockport. If so, the interval between the Nineveh and Lower Rockport limestone is 16 feet more than in the Rockport, Wood County Section (Hennen, 1911: 46-47), the type section for the Rockport limestones.

Locality 23. — Proctor District, Wetzel County, West Virginia

A limestone containing fossils outcrops on the north side of the West P. O. - Newdale Road, about two-tenths of a mile southwest of West P. O., West Virginia. The approximate elevation at this place is 1,140 feet above sea level.

The fossil-bearing bed is a sandy, fresh-water limestone which weathers with a yellowish-brown surface to resemble the matrix of locality 22. However, a fresh surface is light brown in color and so differs from the matrix at locality 22, which is a dark gray on a fresh surface. The thickness of the fossiliferous limestone is more than three inches and probably less than one foot.

This outcrop is four-tenths of a mile west of locality 22 and appears to be at about the same elevation. This limestone may be a sandy phase of the fossiliferous limestone bed at locality 22 and is in this paper tentatively identified as the Lower Rockport limestone.

Locality 24.—Springhill Township, Greene County, Pennsylvania

On the west side of the Hundred, West Virginia-New Freeport, Pennsylvania Road (Pennsylvania Route No. 18) about one-half mile north of Garrison, Pennsylvania, a small collection of fossils was made. The elevation of the fossiliferous stratum is probably between 1,200 and 1,275 feet.

Fossils were found in a fresh-water limestone about six inches thick, which was overlain by one and one-half feet of gray shale and underlain by two feet of calcareous brown shale.

The stratigraphic position of the fossiliferous limestone is uncertain. From the fact that the Nineveh coal outcrops at an elevation of 1,210

feet (Hennen, 1909: 176) at a point two and two-tenths miles to the south, and from the structure as indicated at that point by Hennen (1909, Map of General and Economic Geology), it appears that the Nineveh coal should be present at very nearly the same elevation (1,210 feet) at locality 24.

Until further field observations have been made, the fossiliferous limestone is here tentatively identified as the Lower Rockport limestone.

Locality 25.—Battelle District, Monongalia County, West Virginia

A fossil-bearing shale outcrops on the east side of the road running southeast from Crossroads, West Virginia, at a point one and seven-tenths miles from that town. This road follows the valley of the eastern tributary of Miracle Run for a distance of about one mile south of Crossroads. The fossiliferous bed outcrops at a very sharp turn in the road, at an approximate elevation of 1,360 feet above sea level.

At this place a limestone horizon, represented by several thin limestones with a total thickness of about five feet, outcrops immediately beneath a massive brownish-green sandstone. The fossils were found in the light brown, limy shale included in the upper two feet of that limestone horizon.

With the aid of the Section at Crossroads, made by Hennen and Reger (1913: 94-95), it appears that the fossiliferous limestone is at the stratigraphic position of the Middle Rockport limestone, directly beneath the Taylor sandstone. However, since the elevation of the fossil-bearing bed is only approximately known, it is possible that the bed in question may represent either the Upper Rockport limestone about 30 feet higher or the Lower Rockport about 30 feet lower.

Locality 26.—Liberty District, Marshall County, West Virginia

One-tenth of a mile south of locality 17, and along the east side of the same road, another fossiliferous outcrop was found. This outcrop is about three-tenths of a mile southeast of Adaline, West Virginia. The approximate elevation of the fossil-bearing bed is 1,075 feet above sea level.

Fossils were found in a fresh-water limestone which is gray on a fresh surface, but weathers brownish. The thickness of this stratum is seven inches. This limestone is no. 43 in the Adaline Section which is given following locality 17 in this paper.

This limestone has not been definitely identified. If the tentative identification of the fossiliferous stratum at locality 17 as the Nineveh limestone is correct, it appears that the bed in question here (at locality 26) may be the Middle Rockport limestone since it occurs 81 feet above what appears to be the Nineveh limestone. The interval from the base of the Nineveh limestone to the base of the Middle Rockport limestone is 81 feet in the type section for the Rockport limestones in Wood County (Hennen, 1911: 46). Further identifications and correlations of the Rockport limestones in Marshall and Wetzel counties must be made before the correct intervals in this area can be known.

Locality 27.—Meade District, Marshall County, West Virginia

A fossil-bearing limestone was found scattered along the surface of the hill at a point which is six-tenths of a mile west of the confluence of Maggoty Run, with the southernmost tributary entering it from the west. The place where the fossils were found is one-tenth of a mile southwest of the end of the only private road, which runs west from the public road leading up onto Goshorn Ridge from the mouth of Maggoty Run. The approximate elevation at the point of collection is 1,120 feet above sea level.

A fresh-water limestone about six inches thick was found to carry fossils. The matrix is gray, but weathers light brown.

The stratigraphic position of this stratum is not definitely known. Although this limestone was not in place, it was evident from the extent of the float along the hillside, and from the height of the hill itself (1,140 feet), that the limestone was not far below its original position. From both megascopic and microscopic inspection it appears to be identical to the limestone at locality 26 (bed no. 43 in Adaline Section) which outcrops about one and two-tenths miles to the southeast. Also, at both of these localities the interval to the Pittsburgh coal from the fossiliferous limestones appears to be about 845 feet, from the Map of General and Economic Geology (Hennen, 1909). Hence, it is possible, as in the case of locality 26, that the limestone at this locality may represent the horizon of the Middle Rockport limestone.

Locality 28.—Battelle District, Monongalia County, West Virginia

On the south side of the road (West Virginia Route No. 7) between Cottontown and Wadestown, West Virginia, about 100 yards east of the Wetzel County-Monongalia County line, a number of fossils were collected. The elevation of the top of the fossil-bearing bed is 1,285

feet, as figured from a U. S. Coast and Geodetic Survey bench mark which is located at the north side of the road about 200 feet west of the place where the fossils were collected.

The fossils were found in a soft, light gray shale several feet thick which underlies five and a half feet of limestones and shales.

Hennen and Reger's identification of the Lower Rockport limestone at an elevation of 1,235 feet (Hennen and Reger, 1913: 176), about three-tenths of a mile northeast of this locality, was used to determine the stratigraphic position of the fossil-bearing stratum. As calculated from the above elevation, the bed in question lies about 50 feet above the Lower Rockport limestone. This interval of 50 feet above the Lower Rockport limestone would make it appear that the fossiliferous shale is between the stratigraphic positions normally occupied by the Middle and Upper Rockport limestones. Or it is possible that the intervals have changed, and the fossil-bearing shale might be included in either the Middle or Upper Rockport limestone depending on the extent of change in intervals.

Locality 29.—Franklin District, Marshall County, West Virginia

A few fragmentary fossils were taken from outcrops on both sides of the road, which runs along the ridge between Long Run and Whetstone Creek, at a point one and four-tenths miles east-northeast of the village of Fairview (formerly called Ella), West Virginia. This locality is between a cemetery on the east side of the main road and a private road which leaves the west side of the main road about 150 feet south of the cemetery. Elevation is about 1,330 feet above sea level.

A fresh-water limestone, gray to tan in color, and containing many inclusions of shale, carried the fossils. This limestone is at least three inches thick and possibly as much as one foot in thickness.

The stratigraphic identification of this limestone is not certain. From the structure contours on the Pittsburgh coal (Hennen, 1909: Map of General and Economic Geology) and Pittsburgh coal-Nineveh coal intervals given by Hennen (1909: 175), it would appear that the fossiliferous bed lies approximately 115 feet above the Nineveh coal. This interval of 115 feet above the Nineveh coal, when compared to sections made by Hennen (1909: 105, 155), places the bed in question at, or not far above, the horizon of the Taylor sandstone. If these figures, which are necessarily only approximate, are correct, it would appear that the bed in question may represent the horizon of the Upper Rockport limestone just above the Taylor sandstone.

Locality 30.—Franklin District, Marshall County, West Virginia

This locality is about one-tenth of a mile south of locality 29 (see above) on the west side of the main road. Fossils were found in limestone blocks, which had been piled up across the road from the barn owned by Mr. T. L. Yoho. Unfortunately, the exact source of the limestone is not known. However, it is most likely that these pieces of fossiliferous limestone came from the same bed as at locality 29—possibly the horizon of the Upper Rockport limestone.

Locality 31.—Tucker District, Wirt County, West Virginia

A fossiliferous limestone outcrops on the east side of the road from Limestone Hill to Lockhart P. O. (U. S. Route No. 21), less than half a mile south of Limestone Hill, West Virginia. The elevation of this limestone is 1,060 feet (?) above sea level.

The fossils were found in the first prominent limestone outcropping along the east side of the road south of Limestone Hill. The thickness of this bed was not noted, but is probably less than two feet.

This limestone appears to be the Upper Rockport limestone which was recognized at this place by Whipple and Case (1930: 371) when they collected fossils from it in 1930.

Locality 32.—Liberty District, Marshall County, West Virginia

This locality is two-tenths of a mile south of locality 17 and one-tenth of a mile south of locality 26, along the east side of the same road as at both of these localities. This fossiliferous outcrop is about three and one-half tenths of a mile southeast of Adaline, West Virginia. The approximate elevation at the point of outcrop is 1,220 feet above sea level.

The fossil-bearing bed is a fresh-water limestone with a thickness of five inches. This limestone is in two layers, and fossils were found in the upper layer which is two inches thick. This bed is no. 70 in the Adaline Section which was given with locality 17 on a preceding page of this paper.

The fossiliferous limestone here has not been definitely identified. If the tentative identification of the fossiliferous limestone at locality 17 as the Nineveh limestone is correct, then it is possible that the limestone (no. 70 in the Adaline Section) at locality 32, 228 feet above locality 17, may represent the horizon of the Gilmore limestone.

Locality 33.—Proctor District, Wetzel County, West Virginia

Fossils were collected from an outcrop on the southwest side of the road on Brock Ridge, one and three-tenths miles southwest of West P. O., West Virginia, and one and four-tenths miles southeast of Newdale, West Virginia. The approximate elevation of the outcrop is 1,380 feet above sea level.

A brown and gray clayey shale about six inches thick was the bed from which fossils were taken. Directly above this shale is a fresh-water limestone two feet thick. Beneath the fossiliferous shale is a brown sandy shale.

A hand-leveled section was made by John J. Burke and the writer at this locality. This section was carried up to an outcrop of the Windy Gap coal at a point three-tenths of a mile north of the fossil-bearing outcrop. The section showed that the fossiliferous shale is 53 feet beneath the Windy Gap coal. The two-foot limestone immediately above the fossil-bearing bed is apparently the unnamed limestone, which in the West P. O. Section of Hennen (1909: 154-155) reproduced following the description of locality 22 in this paper, is 50 feet beneath the Windy Gap coal.

Locality 34.—Proctor District, Wetzel County, West Virginia

Along the north side of the Newdale — West P. O. (West Virginia) Road, about two-tenths of a mile northeast of Newdale, a few fossils were collected. The approximate elevation of the outcrop is 1,460 feet above sea level.

The fossil-bearing bed is a fresh-water limestone two to four inches thick which is light brown on weathered surface and gray on fresh fracture. A limestone similar in appearance and thickness, but not containing vertebrate fossils, was observed here 15 feet beneath the fossiliferous stratum.

From the information the writer has about this locality, it appears that the bed in question is most likely about 50 feet below the Windy Gap coal. In Hennen's West P. O. Section, which was made about two and one-half miles east of this outcrop, there are two unnamed limestones 16 feet apart, and the uppermost of these is 50 feet beneath the Windy Gap coal. Although both of those limestones in the West P. O. Section are one foot thick, it is possible that they are thinning out toward the west and that the two limestones two to four inches thick at Newdale represent those same limestone beds. Until more accurate

elevations on these beds are made in the field, it is not possible to give a more exact stratigraphic determination for the fossiliferous limestone at this locality.

Locality 35.—Proctor District, Wetzel County, West Virginia

At this locality a collection was made from an outcrop along the south side of the West P. O. - Silver Hill, West Virginia, Road about six-tenths of a mile east of West P. O. This outcrop is about one-tenth of a mile east of Rosefield schoolhouse. The approximate elevation at the point of outcrop is 1,370 feet above sea level.

The stratum which contained the fossils is a brown sandy shale about two feet thick which grades downward into a siliceous limestone.

From the structural contours based on the Pittsburgh coal on the Map of General and Economic Geology (Hennen, 1909), it appears that this outcrop underlies the Windy Gap coal horizon by about 40 feet. It seems probable that the fossiliferous, sandy shale at this locality is directly over the limestone which in Hennen's West P. O. Section is just 50 feet beneath the Windy gap coal. Further field work would be necessary to make a positive identification of the fossil-bearing bed.

Locality 36.—Center District, Wetzel County, West Virginia

A fossiliferous bed of sandstone was found along the north side of the road leading from Silver Hill, West Virginia, to Miller Ridge Church. This outcrop is six-tenths of a mile northeast of Silver Hill, West Virginia. At the point of outcrop the approximate elevation is 1,380 feet above sea level.

Fossils were found in a sandstone just one inch thick. This sandstone is reddish-brown to light tan in color. Five feet below the fossiliferous sandstone is a freshwater limestone one foot thick.

The stratigraphic position of the fossil-bearing bed is uncertain. From the structure contours on the Pittsburgh coal, on the Map of General and Economic Geology (Hennen, 1909), it appears that the bed in question may be five feet above that limestone, one foot thick, which in Hennen's West P. O. Section is 50 feet below the Windy Gap coal. (This locality is less than three miles northeast of West P. O. where the above mentioned section was made by Hennen.) Further field work would be necessary to definitely place the stratigraphic position of the fossiliferous bed.

Locality 37.—Proctor District, Wetzel County, West Virginia

Seven-tenths of a mile west of Silver Hill, West Virginia, on the east side of the road from Silver Hill to Macedonia School, a small collection of fossils was made. At the point of collection there is an abrupt right angle turn in the road. The approximate elevation of the outcrop is 1,420 feet above sea level.

The fossiliferous stratum is a brown limy clay about four inches thick which overlies a fresh-water limestone one foot in thickness.

The stratigraphic position of this fossil-bearing bed is not definitely known. It is most likely either just above the limestone which in Hennen's West P. O. Section was 50 feet beneath the Windy Gap coal, or just above the Windy Gap limestone. Without further field observations it is impossible to definitely determine the exact stratigraphic position of this fossiliferous stratum.

SUMMARY

Although it had long been known that fossil tetrapods occurred in the Pennsylvanian and Permian rocks of this region, the field parties which found the new localities described in this paper demonstrated that those fossils are much more common than had been generally believed. A total of 37 localities yielded vertebrate fossils and only one locality (no. 31) was not new, Whipple and Case (1930: 371) having made a collection there earlier. Among the 37 localities, there were represented 13 stratigraphic horizons at which neither amphibian nor reptilian fossils had been previously found. At locality 3 were collected the only tetrapod fossils so far reported from the entire Monongahela group.

Before this paper had been prepared for publication (June 1942), there had been described four localities (J, K, L, M) at which vertebrates had been collected within the upper part of the Greene group, from the base of the Nineveh limestone up to the top of the Gilmore limestone. The new localities described in this paper have increased that number to 22, clearly indicating that that part of the Greene group is particularly fossiliferous.

Of special interest are the five localities near West P. O., West Virginia, which appear to be stratigraphically about 50 feet below the Windy Gap coal (localities 33, 34, 35, 36, 37). If the strata at these places are correctly identified, they are the youngest of the Paleozoic rocks in eastern United States known to have yielded vertebrate fossils.

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MAP
OF NORTHWESTERN WEST VIRGINIA AND THE ADJACENT
PORTIONS OF OHIO AND PENNSYLVANIA
SHOWING OCCURRENCES OF UPPER PENNSYLVANIAN AND
PERMIAN TETRAPODS

Previously worked localities..... A, etc.
 New Carnegie Museum localities..... 1, etc.
 Principal area of Dunkard series enclosed within
 heavy line 
 State boundary lines 
 County boundary lines 

Adapted from U. S. G. S. Base Maps of West Virginia, Ohio, and Pennsylvania which have here been reduced to a scale of approximately 18.5 miles to the inch.